

# CLAIMS

1. A variable bleed solenoid which has low leak properties comprising:  
a housing defining an internal chamber therein;  
an electromagnetic coil wound on a bobbin wherein said bobbin is coaxially

5 mounted within the housing;

an axially movable armature mounted in the internal chamber, said armature  
having a first end and a second end;

an actuation member extending from an end of said armature;

a pole piece and flux tube operably associated with said armature for moving  
10 said armature in a first direction upon energizing said coil;

a valve manifold including a passage for a hydraulic supply pressure and a  
chamber leading to a hydraulic control side pressure and for directing said control  
side to an exhaust;

a first valve seat and a second valve seat;

15 a valve positioned for selectively sealing on said first valve seat or said  
second valve seat;

a spring for biasing said armature; and

a control circuit for supplying power to said armature for allowing control of  
said supply pressure in a supply side for sealing the valve in a low leak position.

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2. The solenoid of claim 1 wherein:

said spring biases said valve in a first direction and overcomes supply  
pressure acting on the valve, said armature upon being energized overcoming said

spring and selectively opening said valve for allowing supply side pressure to bleed to the control side pressure port.

3. The solenoid of claim 2 wherein said manifold further comprises a supply  
5 side seat and an exhaust side seat with said valve moving between said supply side seat and said exhaust side seat for selectively and variably positioning therebetween.

10 4. The solenoid of claim 3 wherein the valve is a ball positioned between said exhaust side seat and said supply side seat.

5 5. The solenoid of claim 4 wherein the valve seats are axially aligned with said actuation member.

15 6. The solenoid of claim 1 wherein the armature acts to close the valve upon actuation thereof, said valve being normally open to supply side pressure.

7. The solenoid valve of claim 6 wherein said spring is weaker than said supply side pressure acting on said valve.

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8. The solenoid of claim 7 wherein said valve is a ball valve.

9. A variable bleed solenoid which has low leak properties comprising:  
a housing defining an internal chamber therein;

an electromagnetic coil wound on a bobbin, wherein said bobbin is coaxially mounted within the housing;

an axially movable armature mounted in the internal chamber, said armature having a first end and a second end;

5 an actuation member extending from an end of said armature;

a pole piece and flux tube operably associated with said armature for moving said armature in a first direction upon energizing said coil;

a valve manifold including an aperture for a hydraulic supply pressure and a chamber leading to a hydraulic control side pressure port;

10 a first valve seat and a second valve seat;

a valve positioned for selectively sealing off said passages; and

15 a spring for biasing said armature toward closure of said valve to said supply side pressure, said spring being strong enough to overcome the supply pressure acting against it and said armature overcoming said spring biasing when said coil is energized.

10. The solenoid of claim 9 wherein the manifold further comprises a supply side seat and an exhaust side seat with said valve moving between said supply side seat and said exhaust side seat and to variable positions therebetween.

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11. The solenoid of claim 10 wherein the valve is a ball positioned between said supply side seat and said exhaust side seat.

12. The solenoid of claim 9 wherein the armature is axially aligned with said actuation member.

13. A variable bleed solenoid which has low leak properties comprising:

5 a housing defining an internal chamber therein;  
an electromagnetic coil wound on a bobbin wherein said bobbin is coaxially mounted within the housing;

an axially movable armature mounted in the internal chamber, said armature having a first end and a second end;

an actuation member extending from an end of said armature;

10 a pole piece and flux tube operably associated with said armature for moving said armature in a first direction upon energizing said coil;

15 a valve manifold including an a passage for a hydraulic supply pressure and a chamber leading to a hydraulic control side pressure and for directing said control side to an exhaust;

a first valve seat and a second valve seat;

a valve positioned for selectively sealing on said first valve seat or said second valve seat;

a spring for biasing said armature; and

20 a control circuit for supplying power to said armature for allowing control of said supply pressure in a supply side for sealing the valve in a low leak position;

wherein said solenoid may be configured into either a first proportional or inversely proportional configuration by inverting of the pole piece and flux tube in the housing and replacement of said spring.

14. The solenoid of claim 13 wherein in the proportional configuration the spring biases the valve in a first direction for overcoming supply pressure acting on the valve and said armature upon being energized overcomes the spring and opens the valve for allowing supply side pressure to bleed to the control side pressure port.

15. The solenoid of claim 13 wherein in the inversely proportional configuration said supply side pressure is normally open to control side pressure and said armature closing said valve upon energizing of said coil.

16. The solenoid of claim 15 wherein a spring is utilized that is weaker than the force of said supply side pressure acting on the valve for allowing the normally open condition.

17. The solenoid of claim 15 wherein a spring is configured for moving the armature toward opening of the valve to control side pressure.

18. The solenoid of claim 13 wherein said valve is a ball valve.

19. The solenoid of claim 14 wherein said valve is a ball valve.

20. The solenoid of claim 15 wherein said valve is a ball valve.

21. The solenoid of claim 16 wherein said valve is a ball valve.

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22. The solenoid of claim 17 wherein said valve is a ball valve.

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